

Patent  
Attorney's Docket No. 003277-025

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of )  
Teuvo MAUNULA ) Group Art Unit: Unassigned  
Application No.: 09/897,453 ) Examiner: Unassigned  
Filed: July 3, 2001 )  
For: SYSTEM AND METHOD FOR )  
PURIFYING EXHAUST GASES )

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application on the merits, please amend the application as follows.

**IN THE CLAIMS:**

1. (Amended) A system for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, the system comprising operational units including:  
an oxidation catalyst, a particle separator; and an NO<sub>x</sub> adsorption catalyst , whereby the system reduces the amounts of hydrocarbons, carbon monoxide, nitrogen oxides and particles present in the exhaust gas.

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2. (Amended) The system of Claim 1, wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: the oxidation catalyst, the particle separator, and the NO<sub>x</sub> adsorption catalyst.

3. (Amended) The system of Claim 1, wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: the NO<sub>x</sub> adsorption catalyst, the particle separator, and the oxidation catalyst.

4. (Amended) The system of Claim 1, wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: the NO<sub>x</sub> adsorption catalyst, the oxidation catalyst, and the particle separator.

5. (Amended) The system of Claim 1, an exhaust gas discharge line of each cylinder of the engine is connected to a connecting channel wherein said operational units are arranged.

6. (Amended) The system of Claim 1, wherein an NO<sub>x</sub> adsorption catalyst is arranged in an exhaust gas discharge line of each cylinder of the engine, said discharge lines being connected to a connecting channel wherein said oxidation catalyst and said particle separator are arranged.

7. (Amended) The system of Claim 1, wherein the system includes two or more partial systems in parallel, each of the partial systems comprising said operational units.

8. (Amended) The system of Claim 1, wherein the NO<sub>x</sub> adsorption catalyst and/or oxidation catalyst are disposed in the same structure with the particle separator.

9. (Amended) The system of Claim 1, wherein the oxidation catalyst contains platinum and/or palladium catalytic metal(s).

10. (Amended) A system for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, the system comprising:  
NO<sub>x</sub> adsorption catalysts arranged in each exhaust gas discharge line of each cylinder, or in each of the exhaust gas discharge lines of two cylinders.

11. (Amended) The system of Claim 10, regeneration of NO<sub>x</sub> adsorption catalyst sulfates, reduction of nitrates, and burning of particles is accomplished by periodically using a lean mixture and a rich mixture.

12. (Amended) The system of Claim 11, wherein a ratio defined by duration of the lean phase to duration of the rich phase is more than 3.

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13. (Amended) The system of Claim 10, wherein said NO<sub>x</sub> adsorption catalyst contains catalytic metal platinum and/or rhodium and at least one of the following elements: Ba, Sr, La, Y, Ce, Zr.

14. (Amended) The method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, comprising passing the exhaust gases to be purified through a system according to Claim 1.

15. (Amended) The method of Claim 14, further comprising periodically using a lean mixture and a rich mixture, a ratio defined by the duration of the lean phase to the operation of the rich phase is more than 3.

16. (Amended) The method of Claim 14, further comprising using enrichments with variable durations are for regeneration of nitrates, sulfates, and particles such that said regenerations of sulfates and particles last longer than the regeneration of nitrates.

17. (Amended) A method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, comprising passing the exhaust gases to be purified over an NO<sub>x</sub> adsorption catalyst allowing for regeneration of sulfates with a lean-rich mixture, a ratio defined by the duration of the lean phase to the duration of the rich phase being more than 3.

18. (Amended) A method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, comprising passing the exhaust gases to be purified over an NO<sub>x</sub> absorption catalyst wherein regeneration of nitrates, sulfates, and particles is achieved by periodically adjusting the mixing ratio of the engine from lean to a ratio closer to stoichiometric, the  $\lambda$  value being preferably below 1.2.

19. (Amended) The method of Claim 18, further comprising injecting fuel into the engine or exhaust piping upstream of the NO<sub>x</sub> adsorption catalyst to obtain a substantially stoichiometric or rich mixing ratio, the  $\lambda$  value being below 1.1.

*Please add new claims 20-26 as follows:*

20. (New) The system of claim 12, wherein the ratio is more than 10.

21. (New) The system of claim 13, wherein the NO<sub>x</sub> catalyst further contains at least one of the following elements: Li, Na, K, Rb, Cg, Be, Mg, and Ca.

22. (New) The method of claim 15, wherein the ratio is more than 10.

23. (New) The method of claim 17, wherein the ratio is more than 10.

24. (New) The method of claim 18, wherein the  $\lambda$  value is below 1.15.

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25. (New) The method of claim 19, wherein the  $\lambda$  value is 1 or below.

26. (New) The method of claim 19, wherein the  $\lambda$  value is 0.97-1.00.

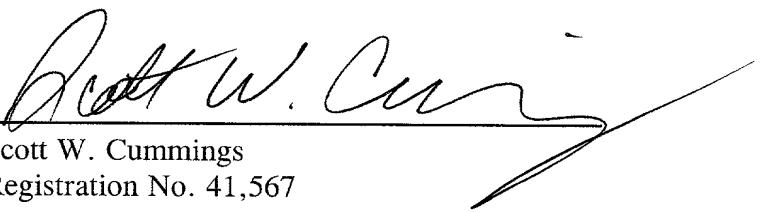
**REMARKS**

The present application has been amended to address formal matters, not related to the statutory requirements for patentability.

Claims 1-26 are pending in the present application. Favorable consideration on the merits is respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By:   
Scott W. Cummings  
Registration No. 41,567

P.O. Box 1404  
Alexandria, Virginia 22313-1404  
(703) 836-6620

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**Attachment to Preliminary Amendment dated October 26, 2001**

**Marked-up Claims 1-19**

1. (Amended) [System] A system for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, [characterized in that this system includes three] the system comprising operational units [being] including:

an oxidation catalyst [3, 3']), a particle separator [(4, 4')]; and an NO<sub>x</sub> adsorption catalyst [(5, 5', 5")], [this] whereby the system reduces [reducing] the amounts of hydrocarbons, carbon monoxide, nitrogen oxides and particles present in the exhaust gas.

2. (Amended) [System] The system of Claim 1, [characterized in that] wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: [an] the oxidation catalyst [(3, 3')], [a] the particle separator [(4, 4')], and [an] the NO<sub>x</sub> adsorption catalyst [(5, 5', 5")].

3. (Amended) [System] The system of Claim 1, [characterized in that] wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: [an] the NO<sub>x</sub> adsorption catalyst [(5)], [a] the particle separator [(4)], and [an] the oxidation catalyst [(3)].

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**Marked-up Claims 1-19**

4. (Amended) [System] The system of Claim 1, [characterized in that] wherein the order of the operational units, in flow direction of the exhaust gas, is as follows: [an] the NO<sub>x</sub> adsorption catalyst [(5")], [an] the oxidation catalyst [(3)], and [a] the particle separator [(4)].

5. (Amended) [System] The system of [any of the above Claims] Claim 1, [characterized in that the] an exhaust gas discharge line of each cylinder of the engine is connected to a connecting channel [(2)] wherein said operational units are arranged.

6. (Amended) [System] The system of [Claim 1, 3 or 4] Claim 1, [characterized in that] wherein an NO<sub>x</sub> adsorption catalyst [(5")] is arranged in [the] an exhaust gas discharge line of each cylinder [(7, 8, 9, 10)] of the engine, said discharge lines being connected to a connecting channel [(12)] wherein said oxidation catalyst [(3)] and said particle separator [(4)] are arranged.

7. (Amended) [System] The system of [any of the above Claims 1 to 4] Claim 1, [characterized in that] wherein the system includes two or more partial systems in parallel, each of [them] the partial systems comprising said [three] operational units [(3', 4', 5')].

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**Marked-up Claims 1-19**

8. (Amended) [System] The system of Claim 1, [characterized in that] wherein the NO<sub>x</sub> adsorption catalyst and/or oxidation catalyst are disposed in the same structure with the particle separator.

9. (Amended) [System] The system of [any of the above Claims] Claim 1, [characterized in that] wherein the oxidation catalyst [(3, 3')] contains platinum and/or palladium [as] catalytic metal(s).

10. (Amended) [System] A system for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, [characterized in that this] the system [includes] comprising:

NO<sub>x</sub> adsorption catalysts [that are] arranged in each exhaust gas discharge line of each cylinder, or in each of the exhaust gas discharge lines of two cylinders.

11. (Amended) [System] The system of [any of the above Claims] Claim 10, [characterized in that the] regeneration of [the] NO<sub>X</sub> adsorption catalyst sulfates, [the] reduction of nitrates, and burning of particles is accomplished by periodically using a lean mixture and a rich mixture.

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**Marked-up Claims 1-19**

12. (Amended) [System] The system of Claim 11, [characterized in that]

wherein a ratio defined by [of the] duration of the lean phase to [that] duration of the rich phase is more than 3[, preferably more than 10].

13. (Amended) [System] The system of [any of the above Claims] Claim 10,

[characterized in that] wherein said NO<sub>x</sub> adsorption catalyst [(5, 5', 5"')] contains [as a] catalytic metal platinum and/or rhodium and at least one of the following elements: Ba, Sr, La, Y, Ce, Zr[, and possibly at least one of the following elements: Li, Na, K, Rb, Cs, Be, Mg, Ca].

14. (Amended) [Method] The method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, [characterized in that] comprising passing the exhaust gases to be purified [are passed] through a system according to Claim 1 [any of the above Claims 1 to 13].

15. (Amended) [Method] The method of Claim 14, [characterized in that] further comprising periodically using a lean mixture and a rich mixture [are periodically used], [the] a ratio [of] defined by the duration of the lean phase to [that] the operation of the rich phase [being] is more than 3[, preferably more than 10].

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**Marked-up Claims 1-19**

16. (Amended) [Method] The method of Claim 14 [or 15], [characterized in that] further comprising using enrichments with variable durations are [used] for [the] regeneration of nitrates, sulfates, and particles such that said regenerations of sulfates and particles [preferably] last longer than the regeneration of nitrates.

17. (Amended) [Method] A method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, [characterized in that] comprising passing the exhaust gases to be purified [are passed] over an NO<sub>x</sub> adsorption catalyst allowing for [the] regeneration of sulfates with a lean-rich mixture, [the] a ratio defined by [of] the duration of the lean phase to [that] the duration of the rich phase being more than 3[, preferably more than 10].

18. (Amended) [Method] A method for purifying exhaust gases of diesel or gasoline multicylinder engines containing, on average, an excess of oxygen, [characterized in that] comprising passing the exhaust gases to be purified [are passed] over an NO<sub>x</sub> absorption catalyst wherein [the] regeneration of nitrates, sulfates, and particles is achieved by periodically adjusting the mixing ratio of the engine from lean to a ratio closer to stoichiometric, the λ value being preferably below 1.2 [and more preferably below 1.15].

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**Marked-up Claims 1-19**

19. (Amended) [Method] The method of Claim 18, [characterized in that]  
further comprising injecting fuel [is injected] into the engine or exhaust piping upstream of  
the NO<sub>x</sub> adsorption catalyst to obtain a substantially stoichiometric or rich mixing ratio, the  
 $\lambda$  value being [thus] below 1.1[, preferably 1 or below, more preferably between 0.97 and  
1.00].